Automation and Employment: What Should (and Shouldn’t) We Worry About?

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Growth Dialogue
22 September 2017
World Bank, DC
Employment of U.S. Adults Has Risen in All But Two Decades of the Last 125 Years

EMPLOYMENT TO POPULATION RATIO OF U.S. ADULTS
1890 - 2015

- 1890: 52%
- 1900: 54%
- 1910: 54%
- 1920: 53%
- 1930: 52%
- 1940: 55%
- 1950: 60%
- 1960: 59%
- 1970: 60%
- 1980: 64%
- 1990: 67%
- 2000: 67%
- 2010: 65%
- 2016: 63%
Why Are There Still So Many Jobs?
O - Ring
Dispensing jobs

As more ATMs were installed in the United States, the number of tellers employed did not drop.

(Thousands)

Never Get Enough
So, Is there Nothing to Worry About?
Wealth ≠ Welfare

World Happiness Report Rankings

GDP Per Capita
- #7
- #11

Healthy Life Expectancy
- #27
- #76

Freedom to Make Life Choices
- #4
- #44

Confidence in National Government
- #33
- #127
What’s the Challenge?
Not Running out of Jobs
U.S. Added 16.6 Million Jobs, Feb 2010 – Jul 2017

Source: U.S. Bureau of Labor Statistics
fred.stlouisfed.org
Biased Technical Change → Shrinking Middle: The ‘Barbell’ Labor Market (AKA Job Polarization)

1979
- Low Skill: 13.7%
- Medium Skill: 61.1%
- High Skill: 25.2%

2016
- Low Skill: 18.2%
- Medium Skill: 43.2%
- High Skill: 38.6%

Tüzemen and Willis 2013
Autor and Dorn 2013
Rising to the Challenge

Johnston 2012
The Contemporary Debate

1. Techno-pessimism
   - Nothing new under the sun (Gordon ‘16)

2. Techno-dystopianism
   - The machines will soon rule the world (Kurzweil ‘05, Musk, Tegmark)

3. Techno-optimism
   - Conditions never better for rapid advances (Mokyr ‘17, Brynjolfsson, McAfee, Rock, Syverson ‘17)

4. Techno-adaptationism
   - Plenty of ‘new work’ for people, big adjustments needed (Acemoglu-Restrepo ‘17, Autor-Salomons’17)
Techno-Pessimism: All of the Great Stuff’s Already Been Invented

Figure 4–1. Diffusion of Modern Conveniences, 1890–1970

Slow Labor Productivity Growth in the U.S. + Developed World in the 2000’s

No Compelling Case that this is Primarily a Mismeasurement Problem

Brynjolfsson, Rock, and Syverson 2017
Buzz Aldrin is Disappointed…

Buzz Aldrin, Apollo 11 Pilot. The second person to walk on the Moon

You Promised Me Mars Colonies. Instead, I Got Facebook.

We've stopped solving big problems. Meet the technologists who refuse to give up.
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Techno-Dystopians – Machines will Soon Rule the World

Probability Robots Will Take Your Job In Next 20 Years, 1=Certain

- Telemarketers: 0.99
- Accountant and auditors: 0.94
- Retail salespersons: 0.92
- Technical writers: 0.89
- Real estate sales agents: 0.86
- Word processors and typists: 0.81
- Machinists: 0.65
- Commercial pilots: 0.55
- Economists: 0.43
- Health technologists: 0.4
- Actors: 0.37
- Firefighters: 0.17
- Editors: 0.06
- Chemical engineers: 0.02
- Clergy: 0.008
- Athletic trainers: 0.007
- Dentists: 0.004
- Recreational therapists: 0.003

Source: The Economist, The Future of Employment: How susceptible are jobs to computerisation?

Based on Frey and Osborne, 2013
Moore’s Law: Transistor Density on Integrated Circuits Doubling Approximately Every Two Years

The Economist Technology Quarterly, March 2016
Median 0 to 60 MPH Acceleration Time of U.S. Vehicles Fell by 50% Between 1983 and 2010

Acceleration Performance of U.S. Vehicles


McKenzie and Heywood 2012
Hours of Annual Motor Vehicle Delay Per U.S. Traveler Rose 100% - 250% Between 1982 and 2005
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Machine Capabilities Rising Exponentially – Productivity Gains May Follow

Image Recognition
Vision Error Rate

Brynjolfsson, Rock, and Syverson 2017
What Makes a Chair a Chair?

Grabner, Gall and Gool, 2001
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Tüzemen and Willis 2013
Autor and Dorn 2013
Some Evidence that Robots Are Diminishing Employment and Earnings

Acemoglu and Restrepo 2017
Robotics May Pose a Greater Challenge to the Value of Human Capital in the Developing World
‘Premature Deindustrialization:’ Manufacturing Employment Peaking at Lower GDP Levels

Fig. 6  Simulated manufacturing employment shares
Premature Deindustrialization: Robotics May Exacerbate the Challenge

1. Manufactured goods become more robot-intensive, less labor-intensive
2. Rich countries more self-sufficient – buying less labor from developing world
3. Might not reduce developing country employment
4. But might shunt labor into low-productivity services, retard development

Rodrik 2015
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Productivity Increase has Always had an Ambiguous Relationship with *Industry not Aggregate* Employment

Figure 1. Production Employment in Three Industries

U.S. Textile Workers 1800-2010

U.S. Primary Iron & Steel Workers 1850-2010

(Buera and Kaboski 2009, Rodrik 2016)
Predicted cumulative percentage employment to working age population change from productivity growth originating in five sectors, summing own-industry and spillover effects: Large countries

(x-axis: year; y-axis: employment to working age population (percent))

Figures are for the total economy, excluding agriculture, public administration, private households and extraterritorial organizations. Productivity is gross output per worker.

Autor and Salomons 2017
Some Preliminary Evidence that the Virtuous Link Between Productivity & Employment is Weakening

Predicted cumulative percentage employment change by decade from value-added based productivity growth originating in five sectors

(y-axis: predicted decadal employment change (%))

Based on sector-specific model from Table 8. Predictions for the 1970s and 2000s scaled up to be comparable to the 1980s and 1990s. Confidence interval constructed by bootstrapping predictions (1,000 repetitions). Productivity is value added per worker.
Robert Heilbroner’s warning in 1964

“As machines continue to invade society, duplicating greater and greater numbers of social tasks, it is human labor itself... that is gradually rendered redundant.”

Herbert Simon’s response to Heilbroner in 1966

“The world’s problems in this generation and the next are problems of scarcity, not of intolerable abundance. The bogey-man of automation consumes worrying capacity that should be saved for real problems...”